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10/572,525	10/26/2007	Xuejun Kang	007989.P002	4632

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EXAMINER
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NGUYEN, KHIEM D

ART UNIT	PAPER NUMBER
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2823

MAIL DATE	DELIVERY MODE
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04/29/2009

PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/572,525	<b>Applicant(s)</b> KANG ET AL.	
	<b>Examiner</b> KHIEM D. NGUYEN	<b>Art Unit</b> 2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 12 March 2009.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-3,5,9,11-13,15,18,19,21,23-31,33,35-38,40-43 and 45-52 is/are pending in the application.
- 4a) Of the above claim(s) 29-31,33,35-38,40-43,45,46 and 49-52 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-3,5,9,11-13,15,18,19,21,23-28,47 and 48 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 March 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date <u>See Continuation Sheet</u> . | 6) <input type="checkbox"/> Other: _____  |

Continuation of Attachment(s) 3). Information Disclosure Statement(s) (PTO/SB/08), Paper No(s)/Mail Date :04/20/07, 04/29/08, 08/07/08, 02/06/09.

## **DETAILED ACTION**

### ***Election/Restrictions***

1. Applicants' election without traverse of Group I, Species I (claims 1-3, 5, 9, 11-13, 15, 18, 19, 21, 23-28 and 47-48) in the reply filed on March 12<sup>th</sup>, 2009 is acknowledged. Claims 4, 6-8, 10, 16-17, 20, 22, 32, 34, 39, 41, and 53 are cancelled. Accordingly, claims 1-3, 5, 9, 11-13, 15, 18, 19, 21, 23-31, 33, 35-38, 40-43, 45-52 are pending in the present application, in which, claims 29-31, 33, 35-38, 40-43, 45, 46 and 49-52 are withdrawn from further consideration as being drawn to a non-elected invention.

### ***Oath/Declaration***

2. The Oath/Declaration filed on March 20<sup>th</sup>, 2006 is acceptable.

### ***Claim Objections***

3. Claim 19 is objected to because of the following informalities: In claim 19, line 2, replace "the ohmic contact layer" with --the second ohmic contact layer--.  
Appropriate correction is required.

### ***Claim Rejections - 35 USC § 102***

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

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5. Claims 1-3, 9, 11-13, 15, 18, 19, 21, 23-28 and 47-48 are rejected under 35 U.S.C. 102(e) as being anticipated by Yang et al. (U.S. Patent 6,649,437).

In re claim 1, **Yang et al.** disclose a method for fabrication of a semiconductor device on substrate **38**, the semiconductor device having a plurality of layers **32, 34, 36**, the method including: (a) applying a seed layer **28** of a thermally conductive metal (gold) to a first surface (top surface) of the semiconductor device; (b) electroplating a relatively thick layer of the thermally conductive metal **26** (copper) on the seed layer **28**, the thermally conductive metal **26** of sufficient thickness to provide a heat sink (see col. 2, line 42 to col. 3, line 10 and FIG. 1); and

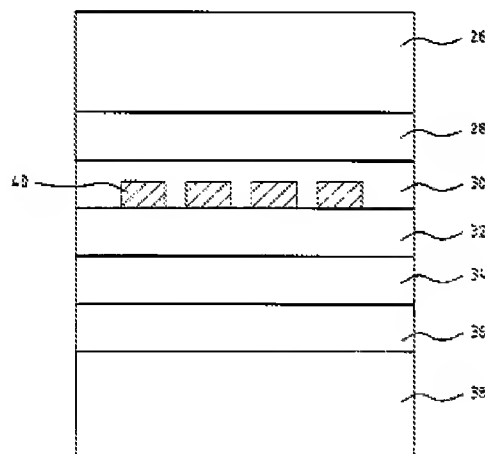


FIG. 1

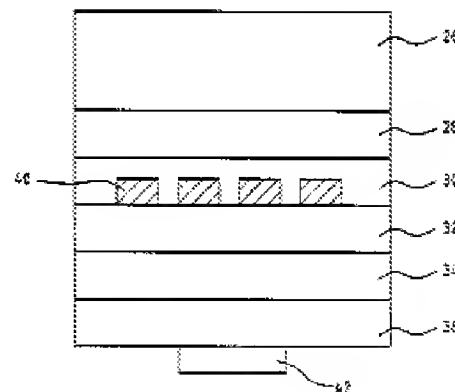


FIG. 2

(c) removing the substrate 38 (see col. 3, lines 11-21 and FIG. 2).

In re claim 2, as applied to claim 1 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the first surface is coated with an

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adhesion layer **30** prior to application of the seed layer **28** (see col. 2, lines 42-66 and FIG. 1).

In re claim 3, as applied to claim 1 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the seed layer **28** is patterned with photoresist patterns before the electroplating step(b), and the electroplating of the relatively thick layer **26** is between the photoresist patterns (see col. 2, lines 42-64 and FIG. 1).

In re claim 9, as applied to claim 1 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the seed layer **28** is electroplated in step (b) without patterning, patterning being performed subsequently by photoresist patterning and then wet etching (see col. 2, lines 42-64 and FIG. 1).

In re claim 11, as applied to claim 3 above, **Yang et al.** disclose all claimed limitations including the limitation wherein patterning is by laser beam micro-machining of the relatively thick layer **26** (see col. 2, lines 42-64 and FIG. 1).

In re claim 12, as applied to claim 3 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the relatively thick layer is of a height no greater than the photoresist height (see col. 2, lines 42-64 and FIG. 1).

In re claim 13, as applied to claim 3 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the relatively thick layer of thermally conductive metal **26** is electroplated to a height greater than the

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photoresist and is subsequently thinned, thinning being by polishing or wet etching (see col. 3, lines 2-21).

In re claim 15, as applied to claim 1 above, Yang et al. disclose all claimed limitations including the limitation wherein after step (c) there is included an extra step of forming on a second surface (bottom surface) of the semiconductor device a second ohmic contact layer **42**, the second ohmic contact layer **42** being selected from the group consisting of: opaque, transparent, and semi-transparent, the second ohmic contact layer being one of blank and patterned, bonding pads being formed on the second ohmic contact layer (see col. 3, lines 11-21 and FIG. 2).

In re claim 18, as applied to claim 1 above, Yang et al. disclose all claimed limitations including the limitation wherein after step (c) ohmic contact formation and subsequent process steps are carried out, the subsequent process steps including deposition of wire bond pads (see col. 3, lines 3-21 and FIG. 2).

In re claim 19, as applied to claim 15 above, Yang et al. disclose all claimed limitations including the limitation wherein the exposed second surface is cleaned and etched before the ohmic contact layer is deposited, the second ohmic contact layer **42** not covering the whole area of the second surface (see col. 3, lines 11-21 and FIG. 1).

In re claim 21, as applied to claim 15 above, Yang et al. disclose all claimed limitations including the limitation wherein after forming the second ohmic contact layer **42** there is included testing of the semiconductor devices on

the epitaxial layers and separating the layers into individual devices (see col. 3, lines 11-21 and FIG. 2).

In re claim 23, as applied to claim 1 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the semiconductor devices are fabricated without one or more selected from the group consisting of: lapping, polishing and dicing (see col. 2, line 42 to col. 3, line 21 and FIGS. 1-2).

In re claim 24, as applied to claim 1 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the semiconductor device comprises a plurality of epitaxial layers **32, 34, 36**, a first ohmic contact layer **40** being on a first surface of the epitaxial layers remote from the substrate **38**; the first ohmic contact layers **40** being on p-type layers of the epitaxial layers (see col. 2, lines 42-64 and FIG. 1).

In re claim 25, as applied to claim 24 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the second ohmic contact layer **42** is formed on n-type layers of the expitaxial layers **32, 34, 36** (see col. 2, lines 42-64 and FIG. 1).

In re claim 26, as applied to claim 1 above, **Yang et al.** disclose all claimed limitations including the limitation wherein after step (c), dielectric films are deposited on the epitaxial layers and openings are cut in the dielectric films and second ohmic contact layer **42** and bond pads deposited on the epitaxial layers (see col. 2, lines 42-64 and FIG. 1).

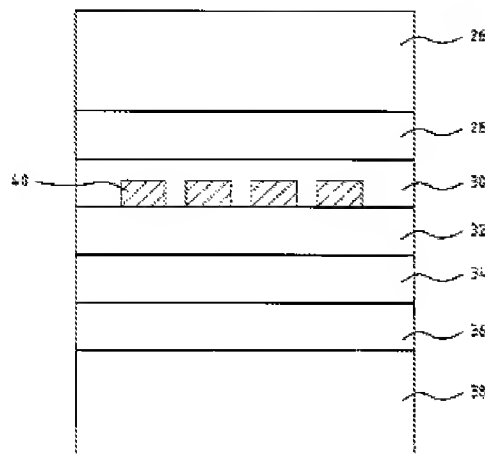


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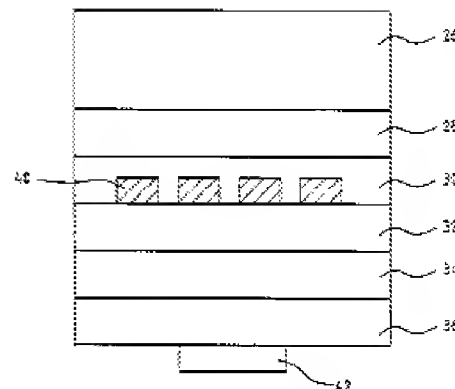
In re claim 27, as applied to claim 24 above, **Yang et al.** disclose all claimed limitations including the limitation wherein after step (c), electroplating of a thermally conductive metal on the semiconductor device is performed (see col. 3, lines 3-21).

In re claim 28, as applied to claim 27 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the thermally conductive metal comprises copper (see col. 3, lines 3-10) and the epitaxial layers **32, 34, 36** comprise multiple GaN-related layers (see col. 2, lines 41-64).

In re claim 47, **Yang et al.** discloses a method for fabrication of a semiconductor device on a substrate **38**, the semiconductor device having a plurality of layers **32, 34, 36** with a device layer, the method including: (a) electroplating a layer of a thermally conductive material **26** onto a surface of the semiconductor device remote from the substrate **38** and close to the device layer (see col. 2, lines 42-64 and FIG. 1); and



**FIG. 1**



**FIG. 2**

(b) removing the substrate **38** (see col. 3, lines 10-21 and FIG. 2).

In re claim 48, as applied to claim 47 above, **Yang et al.** disclose all claimed limitations including the limitation wherein the semiconductor device is a silicon-based device (see col. 2, lines 42-64 and FIG. 1).

***Claim Rejections - 35 USC § 103***

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

7. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yang et al. (U.S. Patent 6,649,437).

In re claim 5, as applied to claim 1 paragraph 5 above, **Yang et al.** discloses wherein between steps (b) and (c) there is performed the additional

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step of annealing the layers to improve adhesion, and the photoresist patterns are of a predetermined height, a predetermined thickness range, and a predetermined spacing range (see col. 2, lines 42-64 and FIG. 1) but do not specifically disclose wherein the photoresist patterns are of a height in the range 15 to 500 micrometers, a thickness in the range 3 to 500 micrometers, and a spacing in the range of 200 to 2,000 microns.

However, there is no evidence indicating the height, thickness, and spacing of the photoresist patterns is critical and it has been held that it is not inventive to discover the optimum or workable range of a result-effective variable within given prior art conditions by routine experimentation. See MPEP § 2144.05. Note that the specification contains no disclosure of either the critical nature of the claimed dimensions of any unexpected results arising there from. Where patentability is aid to be based upon particular chosen dimensions or upon another variable recited in a claim, the Applicant must show that the chosen dimensions are critical. In re Woodruff, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

### ***Conclusion***

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to KHIEM D. NGUYEN whose telephone number is (571)272-1865. The examiner can normally be reached on Monday-Friday (9:00 AM - 6:00 PM).

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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew S. Smith can be reached on (571) 272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Khiem D. Nguyen/  
Primary Examiner, Art Unit 2823